PONTOOSUC LAKE DEEP DRAWDOWN PLAN
August 16, 2011

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APPENDECIES

PREPARED BY

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This plan was written to accompany the applications to the Pittsfield and Lanesborough Conservation Commissions for a deep (up to six feet) drawdown of Pontoosuc Lake (WPA Form 3 – Notice of Intent). The goal is to do a deep drawdown in the winter of 2011-12 and approximately every three years thereafter. In the other years a three foot drawdown will be done. The three foot drawdown has been done for many years, and the permits for this drawdown were renewed for three years in the fall of 2010.

A periodic deep drawdown of Pontoosuc Lake has long been identified as a beneficial lake management means to help control the non-native invasive aquatic plants which are degrading the lake quality. Exploring implementation of a deep drawdown is required by the Order Of Conditions for herbicide control of the invasive plants. The objective of a periodic deep drawdown is to better control the invasive aquatic plants and to reduce the amount of herbicide needed. Control of the non-native invasive species will enable native plant species to better thrive and restore a more natural state of the plant population. Because of these objectives the plan is being proposed as a limited project subject to 310 CMR 10.53 (4) removal of aquatic nuisance vegetation to retard lake eutrophication and the thinning of vegetation to improve habitat value.

There are four co-applicants for this NOI;

- The City of Pittsfield
- The Town of Lanesborough
- The Department of Conservation and Recreation, acting through the Western Region office
- The Friends of Pontoosuc Lake/Watershed Inc.

BACKGROUND

Pontoosuc Lake is a 480 acre lake located in Pittsfield and Lanesborough, about half in each municipality. Until July 2000, the lake was owned by Berkshire County. When the County was dissolved by the state legislature, ownership of the lake was transferred to the Commonwealth. Since that time, the lake has been owned by the Department of Capital Assets Management (DCAM). The dam, which was rebuilt in 2005-6, is the responsibility of the Department of Conservation and Recreation (DCR). The management authority for the lake is divided between both municipalities and several state agencies whose responsibilities range from the maintenance and operation of the dam, permitting authority, and enforcement responsibilities. The Friends of Pontoosuc Lake/Watershed Corporation (The Friends of Pontoosuc) is a volunteer non-profit organization concerned solely with Pontoosuc Lake and its overall management. The organization has worked with the Commonwealth of Massachusetts, the City of Pittsfield, and the Town of Lanesborough in an advisory/advocacy role to maintain and improve the lake. It also has established a variety of effective partnerships utilizing the knowledge and skill base of local groups such as the Berkshire Regional Planning Commission (BRPC), the Lake and Ponds Association of Western Massachusetts (LAPA-West), and the Housatonic Valley Association (HVA).

Pontoosuc Lake is in the early stages of eutrophication which can be attributed to dense development within the watershed and subsequent increases in sediment and nutrient loading through the tributaries and an extensive stormwater drainage system. Non-point source pollution, including erosion must be controlled and actions are being taken as described later. In addition, the excessive growth of nuisance, non-native aquatic plants exacerbates the accelerated eutrophication process because of the large biomass produced by these prolific plants. The excessive plant problem is not a function of pollutant loading from the watershed but rather a result of the nutrients already in the lake sediments. Therefore, in-lake management actions are required. The periodic deep drawdown proposed herein in combination with other measures offers the most promise with the fewest undesirable impacts.

SUPPORTING STUDIES

Several studies and plans for management of the lake and watershed have been developed over the past years and are the source of data for this report and basis for the drawdown program recommended. The most significant of those reports is as follows:

- Pontoosuc Lake Management Plan December 2004 This plan was developed by the Friends of Pontoosuc and the Berkshire Regional Planning Commission using funds provided by the Berkshire Environmental Fund. The deep drawdown is identified in this report as a key element in the multi-faceted approach for the control of non-native invasive plant species.
- Pontoosuc Lake Watershed-based Plan 2008 This plan was developed by the Berkshire Regional Planning Commission using funds provided by the Mass DEP through a Section 319 Nonpoint Source Pollution Competitive Grant.
- Post Implementation Study of Pontoosuc Lake, Pittsfield/Lanesborough Massachusetts. March 2000. This study was funded by the Berkshire County Commissioners. This 2+ inch report is the definitive study of the lake and has a wealth of data on the lake and discussion of management techniques.
- Pontoosuc Lake Vegetation Assessment. November 2003 and Field Guide to Aquatic Plants of Pontoosuc. November 2003. (Appendix C) These reports were prepared by GeoSyntec Consultants. They identify the species, density, and location of weeds in Pontoosuc Lake. The surveys documented are the basis for subsequent surveys (2-3 per year) done by the friends of Pontoosuc personnel who were trained by GeoSyntec as part of the work in 2003.
- Technical and Environmental Evaluation of Lake Level control for Aquatic Plant Management in Pontoosuc Lake, Berkshire County Massachusetts 1989 this study done by IT Corporation, Aquatic Sciences Division, addresses all the issues associated with a 6 foot drawdown. Although 22 years old, most of the information is still applicable.
- Drawdown Effects on Lake Ecology; *Considerations for Management of Pontoosuc Lake* 1 May 2011 This report was written by 3 MCLA ecology students as a project for a water quality course; Mike Hitchock, Jared Swanson, and Nicholas Smith. Their literature search documents the overall positive benefits of a deep drawdown.

- Notice of Intent and NOI narrative for drawdown of Onota Lake approved November 2004. Because of the similarities between Onota and Pontoosuc Lakes, this plan for Pontoosuc Lake draws heavily on the Onota plan prepared by the Lake Onota Preservation Association (LOPA).

In addition to the above, the three EOEEA documents which are the bible for planning and permitting of weed management in Massachusetts and are familiar to all readers of this document are listed below for completeness;

- Eutrophication and Aquatic Plant Management in Massachusetts – Final Generic Environmental Impact Report. Executive Office of Environmental Affairs. July 2003.
- The Practical guide to Lake Management in Massachusetts 2004
- Guidance for Aquatic Plant Management in Lakes and Ponds April 2004

This drawdown plan is intended to be in compliance with the requirements and guidance in all the above three documents

WATER QUALITY

Water quality data has been collected by trained volunteers from the Friends of Pontoosuc for many years. Appendix A is a tabulation of dissolved oxygen and temperature profiles since 2004. No clear trend is apparent; Quality is neither getting better or worse. Of interest is the depth at which DO drops below 6 mg/l. This usually occurs at 15 feet in mid-summer, although sometimes the oxygen is good below 15 feet.

Appendix B is a tabulation of water clarity as measured by Secchi depth. Again, no clear trends. Secchi depth as high as 21 feet was observed in 2007, but in mid-summer readings are typically about 6 feet.

ACTIVITIES TO CONTROL THE INVASIVE PLANT POPULATION

The earliest known action to address the invasive species problem (although it was perhaps not recognized as an invasive species issue) was in the early 1970's. The lake was owned by the County. Herbicide treatments were done occasionally, not every year. A dredging project was attempted in the mid 70's without success. The plan was to drawdown 5 feet and use bulldozers to excavate the lake bottom eliminating the nutrient rich sediment at the lake bottom. Work was initiated in the northwest cove, but the equipment became mired in the seemingly bottomless muck and the project was abandoned. Next the County Commissioners used grant money to buy a fleet of harvesting equipment, and operated a harvesting operation every summer from mid-June through Labor Day. Initially the program was funded by the County, later operated by and subsidized by the county but financially supported by Pittsfield and Lanesborough, and then in 2000 when the County government was dissolved, operated by Pittsfield with costs shared 50:50 with Lanesborough. The harvesting operation was conducted for about 30 years, thru the summer of 2007. During that time the milfoil density continued to get worse, and it was becoming increasingly difficult and expensive to keep the lake clear enough for recreational activities. No doubt spread of the milfoil

was accelerated by the fragmentation which was a by-product of harvesting. An annual drawdown of 3 feet has also been performed from even before the harvesting program. This was initially done primarily for shoreline protection and flood control, but later recognized as an effective check on the milfoil population in the area exposed. The drawdown has been successful for all three purposes in the areas exposed. Through its annual monitoring programs, the Friends of Pontoosuc has documented existing water quality and macrophyte coverage. No adverse impacts from these drawdowns have been noted. In the winter of 2005-6 a 5 foot drawdown was done in order to rebuild the dam. This cleared all the area less than 5 feet deep of milfoil, although there was regrowth by mid-August, probably as a result of fragmentation from the ongoing harvesting.

In 2008 harvesting was discontinued and an annual treatment of the littoral area with the herbicide Reward was started. This was found to be far more effective than harvesting. The application has been done in late May or early June, depending on the status of the milfoil. The objective is to treat early enough to eliminate the curly leaf pondweed before it goes to seed, and late enough to minimize the extent of the milfoil regrowth.

Plans for the future are to continue the annual treatment with Reward augmented by the drawdown plan proposed herein. The long term goal is to weaken the milfoil with the annual herbicide application to the extent that hand pulling of the resilient old root structures can be done to eliminate the regrowth in August, and hopefully even be able to do the treatment less often. Another option which will be considered is to use a systemic herbicide instead of Reward which is a contact herbicide. At the current time there is not a viable systemic herbicide option because of required contact time, cost, and effect on wells near the lake.

STATUS OF AQUATIC PLANT POPULATION IN PONTOOSUC

Pontoosuc Lake suffers varying degrees of problem from four non-native, invasive aquatics. A pioneer infestation of Water Chestnut (*Trapa natans)*, discovered in 2003, is being controlled via hand pulling. European Naiad (*Najas minor)* is prevalent but because it is low-growing and starts growth in late season, it has not reached major problematic levels except in the very shallow northeast cove. Curly-leaf Pondweed (*Potamogeton crispus)* is fairly widespread, but is only a partial season problem due to its predictable early July die-down. Eurasian watermilfoil (*Myriophyllum spicatum)* is the major problem on Pontoosuc Lake.

Macrophyte surveys are conducted by trained Friends of Pontoosuc volunteers, at least twice a year, and often 3-4 times. Appendix C documents the result of the most recent survey which was conducted in September 2010. The results show that the littoral zone (depth of 12-15 feet max for Pontoosuc) supports a variety of aquatic plants including three of the above identified non-native invasives. (No Water Chestnut plants were found in this survey although the volunteer pickers who remove them while

canoeing and kayaking reported removing small quantities throughout mid and late summer.) Milfoil is present in many areas and dominant in some despite the treatment of the littoral zone with Reward in early June. There is a variety of native plants, which is good, although the extent, variety, and density are less than desired.

Control of milfoil with herbicide and drawdown is keeping this very aggressive invader at bay, although better control is clearly needed. Without control the entire littoral zone would be choked with a dense growth of plants reaching the surface. This would add significantly to the bio-mass speeding the eutrophication process. The situation has improved for the native species since the treatments with herbicide began in 2008. Prior to that time the milfoil was dominant all summer and the native species were unable to thrive in any significant quantity. We expect further improvement as a result of the deep drawdown.

AREA, VOLUME, FLOW, AND DEPTH

The table below summarizes the impact on area and volume for a 3 and a 6 foot drawdown. The values include water above the Bull Hill Rd. above the Narragansett Ave. causeway, and the very shallow areas of the northeast cove (Gunns Cove) which are not part of the 480 acres considered the lake proper. Calculations used to develop the numbers in the table are in appendix D. These calculations were done in support of a pilot study to develop guidelines for streamflow during drawdown and refill. The study is a joint effort of the DFW Division of Ecological Restoration (DER), Friends of Pontoosuc, LOPA, and BRPC. The study is not yet complete, but there was agreement on the volume numbers in the table below.

Note that there is little difference between the 3 and 6 foot drawdown levels for the three areas not in the main lake body. This is because the causeways dam the water behind them (the Bull Hill Rd. causeway bottom of the culvert is 4 feet below lake level when full, and the Narragansett Causeway is 3 feet) and the Guns cove area bottom is fully exposed by the 3 foot drawdown.

PONTOOSUC LAKE
VOLUME AND AREA FOR 3 AND 6 FOOT DRAWDOWN

AREA

	FULL	AFTER 3 FOOT		AFTER 6 FOOT	
	acres	acres	% of full	acres	% of full
main body	477.3	465.6		454.1	

Gunns Cove	34.3	0.0		0.0	
North BH	7.7	1.9		1.3	
West Nar	30	10.0		10.0	
Total	549.3	477.6	86.9%	465.4	84.7%

VOLUME

	FULL	AFTER 3 FOOT		AFTER 6 FOOT	
	acre-ft.	acre-ft.	% of full	acre-ft.	% of full
main body	7,111.8	5,696.2		4,314.6	
Gunns Cove	51.5	0.0		0.0	
North BH	15.4	3.9		2.2	
West Nar	48.0	12.0		12.0	
Total	7,226.6	5,712.4	79.0%	4,328.9	59.9%

In considering water volume available for fish the impact of stratification and oxygen depletion must be taken into account. From water quality data in Appendix A, is noted that in December and January there is virtually no volume of water with low dissolved oxygen (DO), but in July and August, all water below 15 feet can be below the DO level necessary for fish survival. This volume is estimated at 1,300 acre feet, which is 18% of the total lake volume. Therefore, for a 6 foot drawdown, the water volume available suitable for fish survival is 73% of that present in a typical summer month.

From the above volume values the flow resulting from drawdown and refill were calculated and are summarized in the table below. (All calculations are in Appendix D.) The first two columns have the flow released by drawdown, or held back during refill, for 3 and 6 foot drawdowns over either 1 or two months. Drawdown is mid-Oct thru mid-Nov, or mid-Oct thru mid-Dec, and refill is all of April, or April and May. The median inflow numbers were provided by DER and are based on the streamflow statistics in a similar watershed in a natural state and scaled for the 21.2 Sq. Mi. area of the Pontoosuc watershed. The last columns are the .5 min and 4.0 max cfs/sec in the GEIR guidelines scaled for the Pontoosuc watershed.

FLOW REQUIREMENTS FOR DRAWDOWN AND REFILL

	drawdown/refill flow (cfs)		median	Total outflow		GEIR RQTS	
	3 foot	6 foot	inflow	3 foot	6 foot	MAX	MIN
Oct-Nov drawdown	24.7		20.7	45.4		84.8	
Oct-Dec drawdown		24.2	25.9		50.1	84.8	
April refill	25.5	49.1	88.4	62.9	39.3		10.6
April-May refill	12.6		68.1	55.5			10.6

The above outflow calculations show that in a median year even a 6 foot drawdown could be accomplished in 1 month without exceeding the GEIR limits, and that refill after a 6 foot drawdown can be done completely in April. However, in order to account for non-nominal conditions as well as to effect a gradual transition as suggested in the GEIR the plan is to conduct the deep drawdown over 2 months, Oct 15 thru Dec. 15, and the 3 foot from Oct 15 to Nov 15. Partial refill from the deep drawdown to 3 feet will commence after the exposed lake bottom has been subjected to a hard freeze, penetrating well into the ground, but no later than Feb. 1. Refill from 3 feet will commence immediately upon ice out. The partial refill to -3 feet will ensure that the lake can be filled while meeting GEIR guidelines even in a dry year. If ice-out has not occurred by April 1, refill to -1 feet will commence, as requested by DFW, in order to facilitate pike spawning, and complete refill will commence as above upon ice-out.

DAM CONTROL

The Pontoosuc Dam which was rebuilt in 2005-6 has three outlets and a downstream flow gage.

- The top spillway, 80 feet wide less the 6 foot wide spillway cut into the top spillway near the gate house. This top spillway determines water level in the lake in the summer.
- A sluiceway 6 feet wide and with a spillway 3 ½ feet below the above wide spillway. An electrically actuated gate controls the opening. This spillway self regulates lake level during a 3 foot drawdown.
- The lower gate which diverts water into an 8 foot pipe under Hancock road and into a channel which joins with the stream from the dam about 300 yards downstream. There is a capability to place stop-logs in a structure around the lower gate which could be used to self-regulate lake level to the elevation of the top log. Because of the difficulty and expense in placing and removing the stop-logs there is no plan to utilize them for the deep drawdown.
- There is a flow gage on the downstream side of the Wahconah Street bridge over the Housatonic west branch before the confluence of the Onota Lake outlet. The flow at the gage includes discharge from storm drains along Rt. 7, but except during and shortly after rain events, virtually all the water measured at the flow gage is from Pontoosuc Lake

The flow over the top spillway and through the sluiceway as a function of lake level and gate opening can be calculated using hydraulics formulae. The flow through the lower gate can't be calculated because we don't know the configuration of the gate, but using the calculations of the other two and measurements at the gage, over time data can be obtained to understand the relationship between settings of the lower gate, lake level, and flow. Flow over the spillways as a function of lake level and gate openings is summarized in appendix F

The operation of these controls during a deep drawdown will be as follows;

1. The lower gate will be opened on about Oct 15 and adjusted so that lake level drops about 36" per month.
2. Flow will be read at the gage, and if it exceeds the max in the table above, the

gate will be adjusted so outflow is no more than 110% of inflow.

3. On Nov 15, if the lake is near 3 feet down, continue as above until Dec 15, otherwise, continue only until the lake is 3 feet down and revise the target to 3 feet.
4. Once the drawdown target is achieved, adjust the gate so lake level is maintained at the target level until a hard freeze of the exposed lake bottom is achieved, but no later than Jan. 31. Then commence a partial refill.
5. For partial refill, adjust the lower gate to achieve the MIN flow in the table above until the lake is at 3 feet down. Then open the sluiceway gate to maintain lake level at the -3 foot level.

For a three foot drawdown operation is the same as above except when -3 feet is achieved proceed to step 5.

For refill, when ice has left the lake, adjust the lower gate for the MIN flow and allow the lake to refill and the sluiceway to maintain the lake at the spillway level. However, if ice-out has not occurred by April 1, close the sluiceway gate and allow the lake to fill to -1 foot, and adjust the lower gate as necessary to maintain the lake at this level until ice-out, then refill as above

FLOW OBSTRUCTIONS IN CHANNEL BEHIND DAM

The lake bottom topography in the outlet channel above the dam could restrict the extent of the drawdown if it is too shallow, and ideally could self-regulate the lake depth if it has a restriction of the right depth and width. The experience during the deep drawdown in 2005 for repair of the dam provides limited insight. Some parties recall that the drawdown depth was limited by channel topography; others recall that a depth of 6 feet or more could be achieved. Also, there is an abandoned waterline behind the dam and there was concern that it would restrict drawdown depth.

Measurements were made of water depth in the channel and the data is in appendix E. The abandoned waterline was found (point 1 in the data) and it is 7 feet from the water surface to the top of the pipe. Therefore, the pipe will not affect the drawdown. A shallow region was found between 470 and 560 feet from the dam. Several measurements of between 5 and 6 feet were made. However, we could not find a continuous shallow ridge across the channel, and there were found a couple paths in the channel with depth of at least 7 feet. It is clear that this shallow region will regulate depth to some level, but it may not be the target -6 feet unless modifications are made. We will assess the situation when the lake is drawn down enough to make observations. If modifications to the bottom topography are desirable we will develop a plan and submit it to the Pittsfield and Lanesborough Conservations Commissions.

KNOWN ENDANGERED SPECIES POPULATIONS

No endangered species of plants or animals have been identified in Pontoosuc Lake. Appendix G is an email from NHESP confirming this and identifying a need to refill in accordance with the GEIR to ensure no impact on wetlands to the north of the

lake where Jefferson Salamanders breed in the spring. A copy of this NOI will be emailed to the NHESP office.

FISHERIES

A pre-permitting meeting was held with the Mass DCR, DEP, and DFW. DFW expressed concern about the higher probability of a fish kill because of the reduced volume of water with high oxygen content. It is desirable to refill by April 1 to help spawning of pike. DFW will provide written comments when the NOI is submitted.

The desirability of a fish screen has been identified by DFW in past discussions of Pontoosuc drawdowns. When the DCR rebuilt the dam in 2005 it was requested that a fish screen be included in the new dam. However, the cost of a fish screen would have added significantly to the cost of the new dam, adding $500,000 to the cost, so the decision was made not to include the fish screen.

The partial refill from 6 to 3 feet in February will cause some inconvenience to ice fishermen. It is noted that a partial refill has often occurred in the past when a winter rain brings the lake level up nearly to the dam crest from 3 feet down. During these natural occurring instances the fishermen have demonstrated the resourcefulness needed to gain access to the firm ice and continue to enjoy fishing.

RESPONSIBLE PARTIES

There are four applicants to this request. Responsibilities for implementation will be shared among them as follows;

1. **DCR;** The DCR is responsible for operating the dam gates which regulate lake level and for recording gate opening and lake level data. The data form in appendix H or something similar will be used to record data. The operator will coordinate with the Friends of Pontoosuc so flow readings can be taken to coincide with lake level measurements and before and after any changes to gate settings. The DCR has no other responsibilities associated with this NOI

2. **Friends of Pontoosuc;** Volunteers from the Friends of Pontoosuc will do all measurements (except lake level and gate settings done by DCR), make decisions/recommendations about commencing refill and changes to gate openings, generate all reports, and do anything else required by the order of conditions for this project. Actions shall include but not be limited to the following;
    - Read stream flow at the gage on Wahconah Street
    - Preform and document macrophyte surveys to evaluate the effectiveness of the drawdown
    - Calculate inflow from lake level change rate and outflow
    - Assess the condition of exposed lake bottom to determine whether the hard freeze objective has been met.

3. **City of Pittsfield** The City acting through the harbormaster will monitor and support actions of the Friends of Pontoosuc and the DCR to ensure compliance with the order of conditions and will approve recommendations by the Friends of Pontoosuc on timing and extend of drawdown and refill actions.

4. **The Town of Lanesborough** The Town of Lanesborough acting through the harbormaster will monitor and support actions of the Friends of Pontoosuc and the DCR to ensure compliance with the order of conditions.

DEEP DRAWDOWN PLAN SUMMARY

The following is a brief summary of the deep drawdown plan:

1. In 2011 a deep drawdown (up to 6 feet) will be attempted. If successful, in subsequent years, a three foot annual drawdown will be performed, followed by additional deep drawdowns every two or three years following a successful deep drawdown. A successful deep drawdown is one which achieves a hard freeze of the exposed lake bottom and thereby eliminates Eurasian watermilfoil in the exposed area. Consecutive years of deep drawdown are not expected to be needed unless unusual weather conditions (warm temperatures or early deep snows) prevent the drawdown from having its intended impacts in a particular year.
2. Deep drawdown years will be coordinated with Onota Lake managers so that a deep drawdown of the two lakes will not be done in the same year.
3. Timing will be the same as has been the historic practice on this lake; commence Oct 15, achieve 3 foot by Nov 15, and in deep drawdown years, achieve up to 6 feet by Dec. 15. Refill to 3 feet commencing Feb. 1, and commence full refill upon ice-out. Complete refill no later than Apr 30 if possible while maintaining the required minimum outflow.
4. If ice-out has not occurred by mid-March, refill will be started then to bring the lake level up to -1 foot by April 1 to help facilitate spawning of pike.
5. Outflows will be maintained between the minimum of 10.6 cfs. and a maximum of 84.8 cfs. (as recommended in the GEIR) with a further limitation of no more than 2 inches / day lake level reduction. However, if there is unusually high inflow during an attempted drawdown, the 84.8 cfs. limit will be exceeded by adjusting outflow to be no more than 110% of inflow, and if there is unusually low inflow during an attempted refill outflow will be adjusted to be at least 80% of inflow.

LIKELIHOOD OF SUCCESS

Since Eurasian watermilfoil is the dominant plant in the deep drawdown zone, and the historic drawdown practice has been highly successful in reducing this milfoil in the areas exposed, deep drawdown could significantly reduce milfoil in additional acres of the lake. This reduction will permit indigenous plant populations to reestablish themselves, promote plant diversity and improve edge habitat, thus improving overall wildlife habitat in the lake.

The GEIR Section 4.2.6.2 lists nine factors to use in determining whether drawdown is likely to be a useful lake management option. Pontoosuc Lake meets all 9 of them fully.

IMPACTS TO THE INTERESTS OF THE WETLANDS PROTECTION ACT

The anticipated impacts of the proposed drawdown to the defined interests of the Wetlands Protection Act as pertains to Pontoosuc Lake are as follows:

1. Protection of public and private water supply: None
    - Pontoosuc Lake is not a surface water supply and surrounding properties are to all be served by Pittsfield or Lanesborough public water supplies.
2. Protection of groundwater supply: Minimal impacts
    - For most of the drawdown period, it will be winter and ground infiltration will be slight due to freezing.
    - Due to the natural impoundments the water level will remain the same as previous winters for the wetland systems north of the Bull Hill Rd. and Narragansett Ave. causeways. The wetland plant communities in these areas have been tolerant of the drawdown that have been undertaken for years and continue to flourish, apparently adapted to the historical conditions of the lake. Small wetland systems in other areas of the lake may experience some drying during the winter season but no more for a deep than a 3 foot drawdown, and will have water levels restored before the new growing season. The plants in these communities have tolerated the previous drawdowns and appear adapted to the variations of a local winter climate conditions.
3. Flood control: Positive
    - Flood storage potential will be increased, which will provide additional control in adverse flood conditions during the winter and early spring.
4. Storm damage prevention Positive
    - Ice damage to shorelines and erosion into the lake has historically been a problem when the lake has not achieved at least a minimal drawdown. Drawdown has prevented this damage with no apparent injury to banks or exposed areas.
5. Prevention of pollution: No apparent impacts
    - No significant impacts are expected to wetlands, oxygen levels or water quality
6. Protection of land containing shellfish No apparent impacts
    - Minimal shellfish resources are present in this lake.
7. Protection of fisheries: Minimal impacts
    - Previous drawdowns, on the same timetable as proposed for this drawdown, have had no discerned impacts on fisheries. Reports from fishing derbies and weigh stations show that large healthy fish, of various species, continue to thrive in the lake.
8. Protection of wildlife habitat Minimal impacts in wetland area / Positive impacts in lake

- See discussion of wetland communities in no.2 above
- In-lake habitat lost diversity over the many years no control and of harvesting because milfoil dominated more and more of the near shore area. Drawdown in combination with herbicide treatment will create an opportunity for the vegetative community to increase species richness. Overall, habitat value should be increased.

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